

# 13.—THE ESSENTIAL OILS OF THE WESTERN AUSTRALIAN EUCALYPTS.

## PART VII.

### THE OIL OF *EUCALYPTUS ERYTHRONEMA*, TURCZ.

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*Eucalyptus erythronema* Turcz. has been recorded as occurring along the Eastern Railway from Tammin to Southern Cross. North of Tammin, it is known at Wyalkatchem and Cowcowing and, farther west and north-west, at Wongan Hills and Ballidu. It also occurs south of the railway, and the material used in this investigation was collected some 10 miles south-east of Merredin.

It is a small tree, 12 to 18 feet high, or a mallee with a bulbous stock and several erect stems. It grows in clay soil, usually associated with *E. salubris* and *E. salmonophloia*, either in the mallee association fringing the woodland or in the woodland. The leaves are lanceolate, narrow lanceolate, or falcate in shape, and are from two inches to four inches long. The colour is a dark and usually lustrous green, the venation of the cineole type and the submarginal vein is removed from the edge. The lamina is copiously dotted with oil glands. The bark is covered with a fine white talc-like powder which easily rubs off, leaving, in the older parts, a pinkish bark. Because of this white powder on the stem and branches, it is commonly called the "white mallee." The wood is dark brown in colour, is very hard and susceptible to termite attack, which, however, is confined to the heart wood.

The material used was collected by Mr. G. E. Brockway of the Forests Department, towards the end of August, 1941. It was obtained from mallees on Avon Location 20751, about 10 miles south-east of Merredin, and its identity was confirmed by Mr. C. A. Gardner, Government Botanist.

The air-dried terminal branches were steam distilled, the oil coming over very rapidly. It was pale yellow in colour and had an irritating odour; the yield averaged from 2.5 to 2.6 per cent. by weight. The physical constants of the oil are those of a typical cineole oil, and its solubility in alcohol shows a low proportion of terpenes. The crude oil itself contains over 70 per cent. of cineole, whilst the rectified oil contains 80 per cent. of cineole. Free acids and esters are present in only small amount, but alcohols, the greater part of which is geraniol, make up more than 13 per cent. of the oil. Both low and high boiling aldehydes are present, but in no great quantity.

The rectified oil, boiling between 164° and 185°, is a very high grade medicinal oil. It makes up over 80 per cent. of the oil, contains, as already stated, 80 per cent. of cineole, and complies with all the requirements of the British Pharmacopoeia for eucalyptus oil. It is colourless and has a very pleasant, non-irritating, camphoraceous odour.

Although clearing for farming has probably removed appreciable quantities of this eucalypt, its commercial exploitation should still be possible. Cultivation should also be economically sound on account of the good yield of high grade oil obtainable from it.

## EXPERIMENTAL.

The oil distilled completely in three hours and the undried oil had the following physical properties at 20° C.:—Specific gravity, 0.923; refractive index, 1.466; specific rotation,  $-0.22^\circ$ . It was soluble in two volumes of 70 per cent. alcohol. Its acid value was 0.6; its saponification values were:—Cold, 1.9; hot, 3.2, corresponding respectively to 0.67 per cent. of geranyl acetate and 1.1 per cent. of total esters calculated as  $C_{12}H_{20}O_2$ . The saponification values of the acetylated oil were:—Cold, 43.8; hot, 52.5, corresponding respectively to 11.5 per cent. of alcohols calculated as geraniol and 13.5 per cent. of total alcohols calculated as  $C_{10}H_{18}O$ . The aldehyde content of the oil was 0.12 millimole per gram of oil, equivalent to 1.8 per cent. of aldehydes calculated as  $C_{10}H_{14}O$ . The cineole content of the dried oil was 70.9 per cent. The usual colour reactions for aromadendrene were obtained but the oil gave no reactions for pinene or phellandrene.

The oil was redistilled and the following fractions were separated:—

Fraction.	Boiling Range.	Amount per cent.	Specific Gravity.	Refractive Index.	Specific Rotation.
1 ...	Up to 160°	2.8	0.897	1.442	$+14.1^\circ$
2 ...	160°—167°	11.75	0.901	1.462	$+16.1^\circ$
3 ...	167°—169°	11.25	0.912	1.461	$+6.5^\circ$
4 ...	169°—176°	57.4	0.920	1.461	$+1.2^\circ$

The residue was further fractionated under reduced pressure and the following fractions separated:—

5 ...	80°—90°/27 mms.	2.2	0.959	1.480	$-23.8^\circ$
6 ...	90°—110°/26 mms.	6.0	0.967	1.494	$-36.2^\circ$
7 ...	110°—120°/25 mms.	1.7	0.965	1.496	$-19.7^\circ$

As the initial boiling commenced, the formation of white insoluble material was noted and from the final residue 2.3 per cent. of white amorphous solid was separated by addition of ether, followed by filtration.

Fraction 1 contained some water which was separated. This contained both aldehydes and free acids, the latter including butyric, probably valeric, and either or both formic and acetic acids. From this aqueous portion a small quantity of colourless crystals separated. These crystals are neutral, soluble in alcohol, may be recrystallised from water, give no colour with ferric chloride, and melt at 145°. From the oily part of this fraction no reactions for pinene were obtained.

Fraction 2 contained 59.3 per cent. of cineole, was colourless and pleasant-smelling, and had cold and hot saponification values of 5.9 and 8.2 respectively.

Fraction 3 was similar and contained 76.5 per cent. of cineole, whilst Fraction 4 contained no less than 88.8 per cent. of cineole. The saponification values of these two fractions were respectively 2.2 and 2.9 (cold) and 3.1 and 3.6 (hot). No crystalline nitrosite was obtained from Fractions 2, 3, and 4.

Fraction 5 was colourless and contained the greater part of the esters, having cold and hot saponification values of 56.6 and 63.9 respectively, corresponding to 20.8 and 22.4 per cent. of esters, calculated as  $C_{12}H_{20}O_2$ . This fraction, as well as fractions 6 and 7, contained a small amount of aldehyde.

Fractions 6 and 7 had cold saponification values of 19.1 and 15.8 respectively and hot saponification values of 22.5 and 20.3.

Fraction 7 (which was pale yellow in colour) and the final residue both gave a purple colouration with ferric chloride.

Distillation of 150 grams of the oil gave 123 grams (82 per cent.) of oil, distilling between  $164^{\circ}$  and  $185^{\circ}$ . This oil contained 80 per cent. of cineole and had the following physical properties at  $20^{\circ}$  :—Specific gravity, 0.918 ; refractive index, 1.461 ; specific rotation,  $+2.76^{\circ}$ . It was soluble in two volumes of 70 per cent. alcohol. The requirements of the British Pharmacopoeia for eucalyptus oil are :—Cineole, not less than 70 per cent. ; specific gravity ( $15.5^{\circ}/15.5^{\circ}$ ), 0.910 to 0.930 ; refractive index ( $20^{\circ}$ ), 1.458 to 1.470 ; optical rotation,  $-5^{\circ}$  to  $+5^{\circ}$  ; soluble in five volumes of 70 per cent. alcohol. The oil gave no reaction for phellandrene and, when tested for aldehydes by the Pharmacopoeial method, required 0.65 ml. of 0.5N alcoholic caustic alkali (B.P. figure, not more than 2 ml.).

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